Information, Computation, Communication

Learning Python

Dictionaries

Agenda

- What is a dictionary
- Initializing, reading, or writing
- Examples of dictionary usage
  - Grouping and counting items
  - Mapping a key to multiple values
- Creating a dictionary
  - fromkeys() and dict()
- Extracting keys or values to a list
- Looping using items()
- Sorting
- Removing items

Dictionaries vs. Lists

Dictionaries and lists are similar

- Both are **mutable**
- Both are **dynamic** (can grow and shrink as needed)
- Both can be **nested** (a list can contain another list or dictionary)

What are the differences, then?

- The main difference lies in how the elements are accessed
  - **List** elements are accessed via their **index** in the list
  - **Dictionary** elements are key-value pairs; to obtain a value, a **key** is needed

Dictionaries

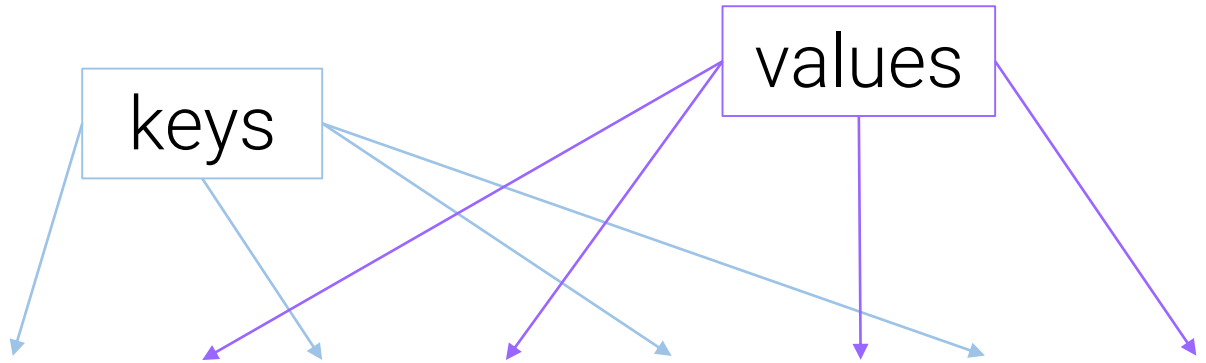
- Dictionaries are **associative** arrays
- Collections of **key:value** pairs
- **Like lists:** Commas separate the elements (i.e., key-value pairs)
- **Unlike lists:** Dictionaries are delimited by curly braces

keys	values
'a'	1
'b'	17
'c'	-1
'd'	4

```
my_dict = {'a': 1, 'b': 17, 'c': -1, 'd': 4}
type(my_dict)  # <class 'dict'>
```

Dictionaries

- Dictionaries are **associative** arrays
- Collections of **key:value** pairs
- Each key-value pair maps the key to its associated value



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Dictionaries

- The values in dictionary elements can be of **any data type**
- Dictionaries are unordered
  - There is no built-in notion of order (i.e., indices) as values are accessed through their keys and not their location in the dictionary
- Any **immutable** Python object type can be used as a **key**
  - Key should not be modifiable (mutable)
  - For example, a list cannot be a key because a list can be modified

```
# Creating an empty dictionary
my_dict = {}
```

Initializing/Reading From a Dictionary

EXAMPLES

```
# Initializing with key-value pairs
my_dict = {'a': 1,
           'b': 17,
           'c': -1,
           'd': 4}
# Get the value associated with a key
my_dict['a']  # 1
my_dict['e']  # Raises KeyError: 'e'
# get() method returns the value for a key if it exists.
# If the key is not found, get() returns None (not an error)
my_dict.get('c')  # -1
```

keys	values
'a'	1
'b'	17
'c'	-1
'd'	4

Writing to a Dictionary

EXAMPLES

```
# Change the value or add a new key-value pair
my_dict['e'] = 5
# Updated dictionary: {'a':1,'b':17,'c':-1,'d':4,'e':5}

# Extending a dictionary with another dictionary
more_data= {'t': [0, 2, 4], 'k': "cheese"}
my_dict.update(more_data)
# {'a': 1, 'b': 17, 'c': -1, 'd': 4, 'e': 5,
#  't': [0, 2, 4], 'k': 'cheese'}
```

Examples of Dictionary Usage

Grouping and Counting Items

Count how many times each word appears in a given string. To split a string into words separated by spaces and return them in a list, use the `split()` method.

```
text = "apple banana apple orange banana apple"
word_count = {}
for word in text.split():
    if word in word_count:
        word_count[word] += 1
    else:
        word_count[word] = 1
print("Word frequencies:", word_count)
# Word frequencies: {'apple': 3, 'banana': 2, 'orange': 1}
```

EXAMPLES

Mapping a Key to Multiple Values

Given an input list of words, group words by their length.

```
words = ["cat", "dog", "elephant", "mouse", "rat", "lion"]
length_groups = {}
for word in words:
    length = len(word)
    if length not in length_groups:
        length_groups[length] = []
    length_groups[length].append(word)
print("Words grouped by length:", length_groups)
#  Words grouped by length: {3:['cat', 'dog', 'rat'],
#                            8:['elephant'], 5:['mouse'], 4:['lion']}
```

Working with Dictionaries

Continued…

Creating a Dictionary with fromkeys()

- The `fromkeys()` method creates and returns a dictionary with the specified keys and the specified value (same for all keys)
- Usage:

```
dict.fromkeys(keys, value)
```

- `keys` is an iterable object (list, string, tuple, range), specifying the keys of the new dictionary
- `value` (optional) is the value for all keys
  - Default value is None

Creating a Dictionary with fromkeys()

Create a dictionary with (a) keys being integers from 0 to 3 and (b) all associated values empty lists.

```
new_dict = dict.fromkeys(range(4), [])

print("New dictionary with empty lists as values:")
print(new_dict)
```

```
New dictionary with empty lists as values:
{0: [], 1: [], 2: [], 3: []}
```

EXAMPLES

Creating a Dictionary with dict( )

EXAMPLES

```
# Create a dictionary using dict() from a list of tuples
students_list = [('Victoria', 286734),
                 ('Jeremy',   234809),
                 ('Katie',    256789)]

students = dict(students_list)
{'Victoria': 286734, 'Jeremy': 234809, 'Katie': 256789}
```

Extracting Keys or Values to a List

EXAMPLES

```
students = dict(students_list)
{'Victoria': 286734, 'Jeremy': 234809, 'Katie': 256789}


list(students.keys())  # List of all keys
# ['Victoria', 'Jeremy', 'Katie']


list(students.values())  # List of all values
# [286734, 234809, 256789]


list(students.items())  # List of key-value pairs as tuples
# [('Victoria', 286734), ('Jeremy', 234809), ('Katie', 256789)]
```

Looping Through Dictionary using items()

```
students = dict(students_list)
{'Victoria': 286734, 'Jeremy': 234809, 'Katie': 256789}

for name, sciper in students.items():
    print(f"Sciper number of {name} is {sciper}")

# Sciper number of Victoria is 286734
# Sciper number of Jeremy is 234809
# Sciper number of Katie is 256789
```

EXAMPLES

Sorting a Dictionary By Key

- By default, if sorted, dictionaries are sorted **by keys in ascending order** (alphabetically)

```
# A dictionary of items with their prices
fruits = {"date": 2.80, "banana": 1.20, "apple": 2.50,
          "elderberry": 1.50, "cherry": 3.00}
# Sorting the dictionary by keys in ascending order
sorted_by_keys = dict(sorted(fruits.items()))

print(sorted_by_keys)
# {'apple': 2.5, 'banana': 1.2, 'cherry': 3.0,
#  'date': 2.8, 'elderberry': 1.5}
```

EXAMPLES

Removing Dictionary Items

EXAMPLES

```
# students = {'Victoria':286734,'Jeremy':234809,'Katie':256789}

# pop() removes an entry, if present, and returns the value
# corresponding to the removed key
students.pop('Lena')      # KeyError: 'Lena'
students.pop('Victoria')  # 286734
# Updated dictionary: {'Jeremy': 234809, 'Katie': 256789}

# popitem() removes and returns the last inserted key-value pair.
# If the dictionary is empty, it raises an error KeyError
my_dict.popitem()  # ('Katie', 256789)
# Updated dictionary: {'Jeremy': 234809}
```

Removing Dictionary Items

EXAMPLES

```
# students = {'Victoria':286734,'Jeremy':234809,'Katie':256789}

# del keyword is used to delete an object (a variable of any
# type); it can also be used to delete a key-value pair
del students['Katie']
# {'Victoria': 286734, 'Jeremy': 234809}

# clear() method empties a dictionary
my_dict.clear()
# {}
```

Next (Last) Topic:
Revisiting Some Topics with Coding Examples